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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/761,477	01/20/2004	Shih-Ho Lin	67,200-1202	2913

7590 08/16/2005  
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EXAMINER	
ALEXANDER, MICHAEL P	
ART UNIT	PAPER NUMBER
1742	

DATE MAILED: 08/16/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b> 10/761,477	<b>Applicant(s)</b> LIN ET AL.	
	<b>Examiner</b> Michael P. Alexander	<b>Art Unit</b> 1742	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 20 January 2004.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

**DETAILED ACTION**

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-6 and 13-14 are rejected under 35 U.S.C. 102(b) as being anticipated by Uzoh et al. (U.S. Pat. 5,807,165).

Regarding claim 1, Uzoh et al. disclose (col. 2 lines 46-58 and col. 4 line 34 – col. 5 line 23) a method that removes a metal layer mechanically from a wafer (which would inherently be removing particles from a wafer), comprising the steps of: providing an electropolishing electrolyte solution; rotating the wafer in said solution; and imparting a positive electrical charge to the wafer by applying an electrical current to the wafer. The Examiner asserts that the mechanism of mechanically planarizing the wafer teaches that the metal would be coming off the surface as particles.

Regarding claim 2, Uzoh et al. disclose (col. 5 lines 10-23) that the electrical current would comprise a pulsing electrical current and disclose applying a negative electrical charge to the wafer in alternating relationship to the positive electrical charge.

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Regarding claim 3, Uzoh et al. disclose (col. 4 lines 55-67) providing a surfactant in the solution.

Regarding claim 4, see the rejection of claim 2.

Regarding claim 5, Uzoh et al. disclose (col. 5 lines 10-23) that the electrical current would be a continuous electrical current.

Regarding claim 6, see the rejection of claim 3.

Regarding claim 13, Uzoh et al. disclose (col. 2 lines 46-58 and col. 4 line 34 – col. 5 line 23) a method that removes a metal layer mechanically from a metal layer (which would inherently be removing particles from a metal layer), comprising the steps of: providing an electropolishing electrolyte solution; providing rotational friction between the metal layer and the solution by rotating the wafer in the solution; and removing metal from the metal layer by electrolysis. The Examiner asserts that the mechanism of mechanically planarizing the wafer teaches that the metal would be coming off the surface as particles.

Regarding claim 14, Uzoh et al. disclose (col. 5 lines 10-23 and Fig. 14) applying waveforms of alternating polarity, which would inherently electroplate metal onto the metal layer in alternating relationship to the removing metal from the metal layer by electrolysis.

Claims 1-2, 5, 13-14 and 16 are rejected under 35 U.S.C. 102(e) as being anticipated by Guldi et al. (U.S. Pat. 6,689,686 B2).

Regarding claim 1, Guldi et al. disclose (Figs. 1 and 3) a method that would inherently remove particles from a wafer, comprising the steps of: providing an

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electropolishing solution; rotating the wafer in said solution; and imparting a positive electrical charge to the wafer by applying an electrical current to the wafer.

With respect to the limitation “for removing particles from a wafer” in claim 1, the Examiner regards this as a purpose of the method. Guldi et al. do not specify using the method for the purpose of removing particles from a wafer. However, the method of Guldi et al. would inherently remove at least some of any particles present on the wafer during stage 50 of the waveform in Fig. 3. All the steps of the disclosed method are the same as the claimed method. Therefore, the claimed method is anticipated.

Regarding claim 2, Guldi et al. disclose (Fig. 3) alternating pulses of positive and negative plating current.

Regarding claim 5, the waveform of Guldi et al. comprises (see Fig. 3) period of continuous electrical current.

Regarding claim 13, Guldi et al. disclose (Figs. 1 and 3) a method that would inherently remove particles from a metal layer on a wafer, comprising the steps of: providing an electropolishing solution; providing rotational friction between the metal layer and the solution by rotating the wafer in the solution; and removing metal from the metal layer by electrolysis.

With respect to the limitation “for removing particles from a metal layer on a wafer” in claim 13, the Examiner regards this as the purpose of the method. Guldi et al. do not state that particles would be present on the surface of the seed layer. However, at least some of any particles present on the surface of the seed layer would inherently be removed during stage 50 of the waveform in Fig. 3. All the steps of the disclosed

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method are the same as the claimed method. Therefore, the claimed method is anticipated.

Regarding claim 14, Guldi et al. disclose (Fig. 3) alternating pulses of positive and negative plating current.

Regarding claim 16, see Fig. 3. Guildi et al. disclose (col. 4 line 24 – col. 5 line 16) that metal is removed during stage 50 and metal is plated during stage 54. Guildi et al. do not specify that the ratio of metal removed to metal plated would be from about 2 to about 5 by weight. However, it is known from Faraday's Law that the amount of metal plated and removed can be estimated by the amount of charge transmitted. Furthermore the amount of charge transmitted can be determined by integrating the current waveform, i.e. the area of the waveform. Returning to Fig. 3, the area of the waveform in stage 50 appears to be about 2 to about 5 of the area of the waveform in stage 54. Therefore, Guildi et al. inherently teach that the ratio of metal removed to metal plated would be from about 2 to about 5 by weight.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 3, 7-12, 15 and 17-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Guldi et al. as applied to claim 1 above, and further in view of Taylor et al. (U.S. Pat. Pub. 2002/0056645).

Regarding claim 3, 7, 10 and 15, Gildi et al. do not specify the composition of the electrolyte. However, Taylor et al. disclose (0074, 0140) an electrolyte comprising copper sulfate, sulfuric acid and polyethylene glycol of the molecular weight 2500-5000. Taylor et al. disclose that electroplating from the disclosed solution gave superior results. It would have been obvious to one of ordinary skill in the art to combine the electrolyte of Taylor et al. with the method of Gildi et al. because the electrolyte gives superior results.

Regarding claims 8 and 11, see the rejection of claim 2.

Regarding claims 9 and 12, see the rejection of claim 5.

Regarding claims 17 and 19, Guldi et al. disclose (Figs. 1 and 3) a method that would inherently remove particles from a via opening lined by a seed layer on a wafer, comprising the steps of: providing an electropolishing electrolyte solution; providing rotational friction between the seed layer and said solution by rotating the wafer in said solution; and removing metal from the seed layer by electrolysis. Guldi et al. do not specify removing particles and do not specify that the solution would comprise copper sulfate and sulfuric acid.

With respect to the limitation "for removing particles" in claims 17 and 19, the Examiner regards this as the purpose of the method. Guldi et al. do not state that particles would be present on the surface of the seed layer. However, at least some of any particles present on the surface of the seed layer would inherently be removed during stage 50 of the waveform in Fig. 3. All the steps of the disclosed method are the same as the claimed method. Therefore, the claimed method is anticipated.

With respect to the electrolyte solution comprising copper sulfate and sulfuric acid in claims 17 and 19, Taylor et al. disclose (0074, 0140) an electrolyte comprising copper sulfate, sulfuric acid and polyethylene glycol of the molecular weight 2500-5000. Taylor et al. disclose that electroplating from the disclosed solution gave superior results. It would have been obvious to one of ordinary skill in the art to combine the electrolyte of Taylor et al. with the method of Gildi et al. because the electrolyte gives superior results.

Regarding claim 18, Guldi et al. disclose (Fig. 3) providing a step of electroplating metal onto the seed layer in alternating relationship to the removing metal from the seed layer by electrolysis.

Regarding claim 20, see the rejection of claim 16.

### ***Conclusion***

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Bajaj et al. (U.S. Pat. Pub. 2003/0201185) and Qingtang et al. (TW 221315B) disclose substantially similar methods for removing particles from a seed layer prior to electroplating.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael P. Alexander whose telephone number is 571-272-8558. The examiner can normally be reached on M-F 8:30-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy V. King can be reached on 571-272-1244. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.



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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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